SERIOUS GAME FOR INTERNAL MEDICAL PRACTICE (CROWD SIMULATION)

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ABSTRACT

Crowd simulation is now being widely used in various virtual environment applications such as entertainment, games and virtual environment. With the existing of crowd simulation in those applications can provide an immersive feeling into static scenes therefore elevate the realistic of the systems. The collision avoidance is important for a large number of characters in a same area, it used to prevent or avoid any collisions among character. Collision avoidance is one of the important elements that needed for construct crowd simulation. Besides that, steering is another important element for the simulation crowd system. By utilize this two elements, the application can produce higher level of realism of crowd simulation as well as make the applications more realistic and interesting. The comparison among different technique has been presented here.

ABSTRAK

Simulasi orang ramai kini sedang digunakan secara meluas dalam pelbagai aplikasi persekitaran maya seperti hiburan, permainan dan persekitaran maya. Dengan yang sedia ada simulasi ramai dalam permohonan mereka boleh memberi perasaan mendalam ke dalam adegan statik itu meningkatkan realistik sistem. Mengelakkan perlanggaran adalah penting bagi sebilangan besar watak-watak dalam kawasan yang sama, ia digunakan untuk mencegah atau mengelakkan sebarang pertembungan antara watak. Mengelakkan perlanggaran adalah salah satu elemen penting yang diperlukan untuk membina simulasi orang ramai. Selain itu, pemandu adalah satu lagi elemen penting untuk orang ramai sistem simulasi. Dengan menggunakan dua elemen ini, aplikasi ini boleh menghasilkan tahap yang lebih tinggi realisme simulasi orang ramai serta membuat permohonan yang lebih realistik dan menarik. Perbandingan antara teknik yang berbeza telah dibentangkan di sini

TABLE OF CONTENTS

Page

LIST OF TABLES

Table Number **Page**

LIST OF FIGURES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Crowd simulation is about simulating the movement of a large number of characters which also consider as virtual environment. Crowds have been study as scientific interest since the end of 19th century. Crowd can do anything superior difficult motion that which is over the maximum ability of human. Nowadays, games is not only designed for entertainment but have been created for some field to undergo some simulation, such as medical field.

Crowd simulations have become more and more significant in the computer game industry no matter is entertainment game or serious game. This project is about to create a serious game for those medical student to let them learn more knowledge and simulate through games. Mostly they do not have enough time and opportunities to get contact with patient. In order to let medical student and medic to have a real experience from the game, one of the important factors is the environment in the game. In the actual environment of hospital, there is full of visitor in morning section, hence we implement crowd simulation into this serious game to make the virtual environment of the serious game be like actual hospital.

A perfect designed game with a well game environment can be easily lead player enter the situation inside the game, and then player can easily grasp the environment of the game. For example , when a virtual patient in the game have an emergency state, medical students can apply their medical knowledge into the game, and see whether the virtual patient get recovery or their state back to stable as previous.

1.2 PROBLEM STATEMENT

Most of the time, medical students does not have the enough opportunities to treat patients during their study because most of the patient lack of trust on them, and feel that medical students does not have enough experiment on treat patient. Due to lack of opportunities on treat patient so medical students cannot get to know the real situation in hospital. Therefore they may be scare of the crowd in the real situation. Through the crowd simulation of the serious game, medical students can get to know the situation and environment in hospital and suit themselves into the situation and environment.

1.3 OBJECTIVES

The objective of this project is:

(i) To simulate the hospital crowd as an obstacle for medical students to find the shortest path to reach therir patient

(ii) To simulate the hospital crowd taht moving around without colliding with each other and the static object.

(iii) To contribute in the development of crowd simulation this serious game.

1.4 SCOPE

The scope for develop this project is:

(i) Develop an actual human crowd for hospital simulation which contain these character, doctor, patients, and visitors to he hospital.

(ii) The numbers of crowd in the hospital will be change according to the visit time hour in hospital. For example, during day time the numbers of crowd will be more than the crowd at night time.

(iii) The movement of crowd in the game is random which mean they are not moving to same position and change same direction at the same time .

1.5 THESIS ORGANIZATION

This thesis consists of 5 chapters. However chapter 1 is discuss about the introduction on the study of crowd simulation in serious game. There are few of the elements that have to focus and various techniques is required will be talk over in this chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 Literature Review

A crowd is not only a group of various kind of person that occupying a common area but them also will give appropriate response to the change of the environment, having interaction among each other. The past few years, crowd simulation on computer has been widely used in various fields such as safety modelling, entertainment software, architecture and so on. Recently, serious game with crowd simulation has been putting on an important position in medical field. Heiko Aydt, Michael Lees, Linbo Luo(2011) state that one of the great motivation to simulate virtual crowd is to build believable characters in the movie and computer games [1]. Ramy Taher Makram Wassef and Awad Khalil (2011) pointed out: "Since past decade, crowded scenes had been an important territory of research." And find out that researchers focused on randomizing thee movement and the appearance of those characters in such scenes. The technique that required to generate the randomize movement of the 3D crowd in real-time using inexpensive pixel shader operations.

There are numerous of article and journal we found from network to find out that crowd simulation is done based on actual environment in real world. Frederic D. McKenzie, Mikel D. Petty and Paul A. Kruszewski (2007) state that to develop a crowd-modelling capability for military simulation is required analysis to the identify military simulation crowd- modelling requirements, need to examine psychological research relevant to crowd modelling. To produce not only a highly realistic simulation but also an easily reconfigurable game AI behaviours this research is been drove an assembly of the military simulation technology with gaming simulation technology.

Branislav Ulicny and Daniel Thalmann (n.d.) pointed out goal of simulation is to reproduce realistic screenplays for those conditions develop in real-time which involve large amount of virtual human agents. In this paper, they conclude that multi-agent architecture allowed virtual human crowd to be execute autonomous behaviour in a virtual environment. In the system created by them, those crowd is being create as collection of humans which able to response to the environment.

Noralizatul Azma Bt, Abdullah Bin Bade and Sarudin Kari (2009) pointed out that without collision avoidance the crowd simulation will be does not look realistic. Collision avoidance technique which mean that to avoid collision of two or more object, include static object and dynamic object. Implement crowd simulation can make the player or user trapped in situation. Besides that, a realistic crowd simulation will occurred if there is collision avoidance implemented.

Ramy Taher Makram Wassef and Awad Khalil (2011) said that there is a major problem faced by game designer which is character repetition. They have undergo several study involved few test on human subjects; the repetition in appearance is more easy to get notice than repetition in animation. They are used the colour modulation technique to create different character of crowd. A model can have many characters by changing its texture and colour of clothes.

N. Pelechano, B. Spanlang and A. Beacco (n.d.) found that an animation planning mediator (APM) will select the most appropriate and will modified the skeletal configuration of each character of crowd. The APM allow us to accelerate the crowd motion and increase the number of locomotion types.

Heiko Aydt, Michael Lees, Linbo Luo, Wentong Cai, Malcolm Yoke Hean Low, and Sornum Kabilen Kadirvelen (2011) state that they use emotion engine which can realise emotional and reflect pacifying soldier response. Those of the effect from different character will be reflected into the crowd behaviour. Their emotion engine is able to manage general emotions but there is one emotion they have to concern is anger.

Christian Gloor(2012) state that for PEDSIM need to maintain in individual particle. Besides that, each pedestrian are able to make own decision (route choice). It control in two layers which is physical and mental. However for physical layer is

take care of the movement of pedestrian, interaction between pedestrians and interaction between pedestrian and environments. For mental layer consist two mental strategy which is Look Ahead and Route Generator. Look Ahead Mental Strategy tells each pedestrian to looks for other pedestrian who in front of them and count the pedestrian on the left and right, walk to the area which have less pedestrians. Therefore, collision avoidance among pedestrian and building have to avoid by pedestrian itself. Route Generator says each of the pedestrian have own routes. Technique transportation is to generate all day long activity for pedestrian and destination of each activity.

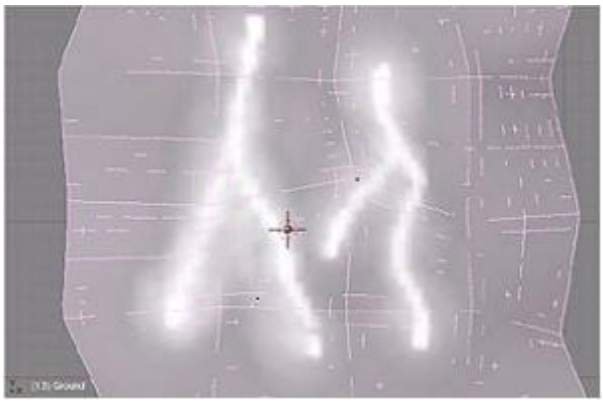

Figure 2.1: Pedestrian will gravitate toward the brighter painted pathways

Roland Hess (2005) states that BlenderPeople support character animation. It is combination of Blender 3D, Python programming, MySQL database which can generate and track motion and interaction of actors within a simulated environment. For best result, gradate the painting away from barrier, allow agents to sense "something", they may route around it. Besides that, it requires to create a white path across a field which is dark color; attract actors toward it by graduate the brightness of path.

Nicolas Brodu (2004) pointed that Crogai introduce AI in crowd behavior scenarios. In Crogai will be use Collision avoidance and detection. Collision avoidance is to find a steering force to prevent the collision. However Collision detection is determine whether two agents are occupying the same space or not. Besides that, the collision avoidance of Crogai needs only be applied at AI frequency, to produce a steering force. Next, for the collision detection is assumed that the AI frequency is enough to capture changes in the neighbourhood are allows

using only the current list of neighbours for distance comparisons. If there is an agent far away in less than an AI cycle it will not be detected.

Arges Systems Inc (2009) state that collision avoidance and steering can be done in UnitySteer. UnitySteer contain few classes which can help in game characters or object maneuver around the scene such as How to accelerate and for how long? How to act when avoiding from obstacles or neighbors? How to keep distance from other agents? UnitySteer are built upon OpenSteer and OpenSteerDotNet. Besides that, dynamic object will keep distance with the obstacles since it can sense the distance between obstacles.

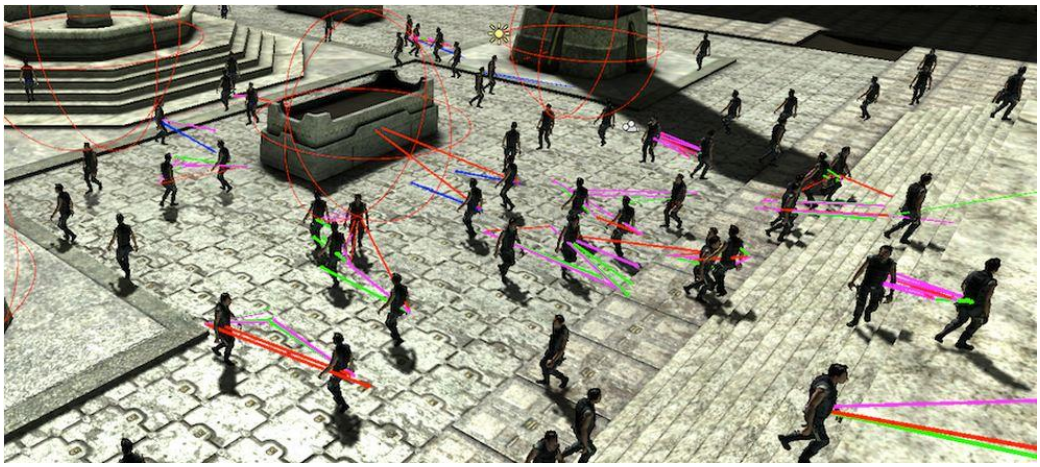

Figure 2.2: UnitySteer update to spherical obstacles avoidance

In short I can summarized that create a serious game based on the real environment is the only way to be successfully complete the game. Previously, game developer just focus on the main character of the game. Nowadays, they realized that the realism of game is important. To make the game more realistic have to observe and study the real environment in the hospital and the crowd behavior in hospital. The crowd will have different reaction among each other with the change of the environment. There are many different techniques and methods can be used to developed crowd simulation based on the few review. Each of the technique can bring different effect in the virtual environment to user.

Chapter 3

METHODOLOGY

3.1 Introduction

This project is a serious game in internal medicine. This project will be constructing step by step based on the software development methodology that I had chosen. There is few activity have to have to be consider during the research development.

First of all, I will study on previous work that how are they going to create crowd simulation. I will look on the requirement regarding what type of crowd is needed and study on the different among each technique such as what effect can those different technique present in the game, choose the most suitable technique that use for crowd simulation .

For the next step will be prepare the content which means the crowd model that suitable to be used in hospital environment and animate those crowd with the technique or classes that I choose to apply on the crowd model. After applied technique on crowd model, we can test for the movement and reaction between crowds, crowd with obstacles. Therefore, check for any unnatural movement, any collision and intersection among them, the reaction of crowds when they are near to each of them and the amount crowd will change according to the visiting time of actual hospital.

Therefore, deploy it into actual scene and combine with my part with other partners who in charge in different part of this project. After we done the combination, we will test and check for any error or bug. If there is no error or bug, we will user which is medical student to test for it, let them comment on this system.

Lastly, if there is any good opinion and logic suggestion from user (medical students) we will improve our system based on their comment.

3.2 Methodology

3.2.1 Development Plan

The methodology that I have chose to use for the development of this project was ADDIE model. ADDIE model is basically a generic, systematic, step-by-step framework. ADDIE model is a instructional design model that comprising five phases: Analysis, Design, Development, Implementation, and Evaluation. The diagram at below show the ADDIE model.

Figure 3.1: ADDIE Model

Step 1 : Analysis

- Analyse the problem from previous work
- Anayse the goals and objectives of our system.
- Analyse the technique have been use in previous study.
- Analyse the actual environment of hospital(Hospital Tengku Ampuan Afzan).
- Analyse the movement of crowd in hospital(Hospital Tengku Ampuan Afzan).
-

Step 2:Design

- Design the 3D crowd simulation of hospital
- Design the collision detected between crowds, crowds with obstacles.
- Design the reaction for crowd when there is a threat of collision happen
- Design the reaction for crowd when there is a pontential collision happen
- Design the coding for system flow.
- Design the flowchart of this system.

Step 3: Development

- Develop the 3D crowd simulation of hospital
- Develop the collision detected between crowds, crowds with obstacles.
- Develop the reaction for crowd when there is a threat of collision happen
- Develop the reaction for crowd when there is a pontential collision happen
- Develop the coding for system flow.

Step 4: Implementation

- Test the system and check for any error or bugs.
- Test by user.
- Feedback from user on this Serious Game.

Step 5: Evaluation

- Review and evaluate each phase to ensure it is accomplishing what it is supposed to do
- Observe the tasks that were trained by the learners and its implication
- Revise the system to make it better and to meet future challenges

3.2.2 Chosen Technique

This project is about a serious game for internal medicine which develops for medical students. It was not an easy task to let medical students integrate into game environment, a well design for virtual environment of game is necessary and important. After the comparisons between four open source have been used in crowd simulation, UnitySteer is the most suitable open source being use in develop this project. For my part crowd simulation, after done the development will be integrated into Unity game so must use UnitySteer to generate it. Some of the opensource such as Crogai is use (Artificial Intelligence) AI for their crowd simulation. Refer to our implementation of those crowd did not need or require any advanced or specific AI. AI require a lot of coding, and a lot of code will cause the processing became slow, we are not consider about it, this project will be implemented through internet which require fast connection.

	UnitySteer	PEDSIM	Crogai	BlenderPeople
Obstacle avoidance & Steering	✓	X	✓	X
Collision avoidance & detection	✓	✓	✓	✓
Generate and track motion and interaction	X	X	X	✓
Collision avoidance & transportation	X	✓	X	X

Table 1: The comparison between different tools.

The crowd is form by visitors, doctors and nurses. For this game, we are focusing on how the doctor gives treatment to patients. The crowd simulations in this serious game no need interaction among crowd itself and they does not need any extra motion other than walking. For the technique collision avoidance and transportation, does not needed in this serious game. Transportation is kind technique that generate activity for each pedestrian, however, the crowd in this project just have to walk around the hospital to create the realistic of the environment where they does not have to have own task or activity.

3.3 Hardware and Software

To develop this project, I have use laptop which the brand of Toshiba Satellite L840 Series. This processor for this laptop is 2nd generation Intel Core™ i5-2450M , the clock speed is 2.50 GHz. This laptop is using Windows 7 Home Premium 64-bit Operating System. The installed memory (RAM) for this laptop is 4GB besides that the hard disk capacity is 640GB. Build in graphic card for this laptop is AMD Radeon ™ 7670M (1GB dedicated memory).

However, for the software that I have choose to develop this project was Unity 3D.Unity 3D is a powerful rendering engine fully integrated with acomplete set of intuitive tools andrapid workflows to create interactive. The project can be program in C++, JavaScript, Boo. This Unity 4.0 have added some new features and some improvements which include HDR rendering, linear space lighting, multi-threaded rendering and so on.The code in Unity 3D is more stable compare to written in other languages. Therefore it had reduce a lot of errors that developers will do normally.

3.4 Gantt chart

Gantt chart is a type of planning and control chart, designed to show graphically the relationship between planned performanceand actual performance over time.[Refer to Appendix A]

Chapter 4

DESIGN AND IMPLEMENTATION

This paper proposes crowd simulation in virtual hospital environment. This project is focusing on simulate the crowd in virtual hospital environment. This chapter discuss about the framework, approach and process of data gathering on this research.

4.1 DESIGN

This research is about the simulation on crowd in a hospital; how the crowd will be react on when they have any collision between other character and obstacles. Therefore the model of this research must contain human character and some obstacles.

Before any model has been design or draft, I had a general hospital in Kuantan named Hospital Tengku Ampuan Afzan visited under the lead of my project supervisor. The purpose to visit the hospital is to analyze the environment of an actual hospital and the movement of crowd in hospital. Figure 4.1, 4.2 and 4.3 shows the environment which is the lobby of hospital and the movement of crowd in hospital.

Figure 4.1 Crowd in lobby of hospital

Figure 4.2 Crowd in lobby of hospital

Figure 4.3 Crowd in lobby of hospital

The initial model of the research is designed based on the analysis and data I get from visit Hospital Tengku Ampuan Afzan. There are some human characters in the scene and with some sphere shape object as the obstacle in hospital, th human character will wander around in planar and avoid to collide with each other and also the obstacles. Figure 4.4 is the initial model designed based on analysis.

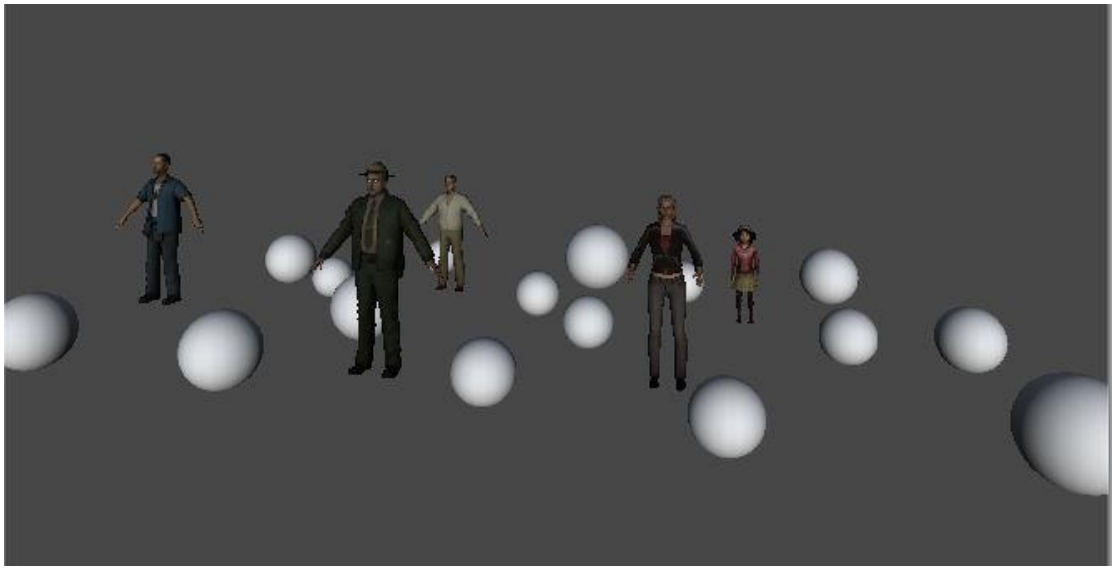

Figure 4.4 Initial model of project

Before I visit the hospital, I had made some research on what kind of information I needed and help me on the development of the project. Therefore, I had discuss with my supervisor on where and when to collect the information that I needed to be used on the development of this project. In the hospital, I have to observe on the reaction and movement of visitor, doctor and nurse, the flow of visitor to visit hospital based on the visiting hour and the environment of the hospital.

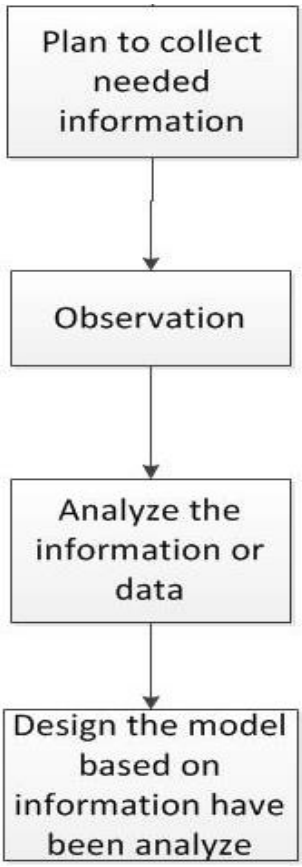

Figure 4.5 work flow

Before start my to develop my project, I need to collect the needed information to be used in my project through observation of the hospital environment. After that, analyse the information I got through the observation in hospital. Therefore, start to design the model based on the information I have been collected.

4.2 IMPLEMENTATION

Figure 4.6 is another prototype of my model. First of all, the sphere shape objects created to play the role as the obstacle in hospital environment however the bullet shape object is created as the visitors which include doctor and nurse in hospital. The bullet object will be wander around on the plane have been created without collide with any obstacles. The movement and the direction changing of the bullet shape object will be based on the script have been written on it.